1061. (amended) The method of claim 1058, wherein at least one of the heaters comprises a surface burner.

1062. (amended) The method of claim 1058, wherein at least one of the heaters comprises a flameless distributed combustor.

1063. (amended) The method of claim 1058, wherein at least one of the heaters comprises a natural distributed combustor.

1067. (amended) The method of claim 1058, wherein providing heat from the one or more heaters to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

1069. (amended) The method of claim 1058, wherein providing heat from the one or more heaters comprises heating the selected formation such that a thermal conductivity of at least a portion of the pyrolysis zone is greater than about 0.5 W/(m °C).

1094. (amended) The method of claim 1058, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well.

1095. (amended) The method of claim 1058, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

37 1086. (amended) The method of claim 1058, further comprising providing heat from three or more heaters to at least a portion of the formation, wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

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38 35 5397. (amended) The method of claim 1094, wherein at least about 20 heaters are disposed in the formation for each production well.

39 1 5440. (new) The method of claim 1058, wherein the pyrolysis zone comprises a selected section.

40 1 5441. (new) The method of claim 1058, wherein at least one of the heaters is disposed in an open wellbore.

SUBE9 5442. (new) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation, wherein one or more heaters provides a heat output of less than about 1650 watts per meter;

allowing the heat to transfer from the one or more heaters to a pyrolysis zone of the formation;

controlling a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than 25; and

producing a mixture from the formation.

42 41 5443. (new) The method of claim 5442, wherein the pyrolysis zone comprises a selected section.

SUBE10 5444. (new) The method of claim 5442, wherein at least one heater comprises a natural distributed combustor.

5445. (new) The method of claim 5442, wherein at least one heater is disposed in an open wellbore.

5446. (new) The method of claim 5442, further comprising producing a mixture from the pyrolysis zone, wherein the mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

5447. (new) The method of claim 5442, further comprising controlling a pressure and a temperature within at least a majority of the pyrolysis zone, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5448. (new) The method of claim 5442, wherein providing heat from the heaters to the portion of the formation comprises:

heating a selected volume (V) of the formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

5449. (new) A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more heaters to at least a portion of the formation;

allowing the heat to transfer from the one or more heaters to a part of the formation;

controlling a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than 25; and

producing a mixture from the formation, wherein the mixture comprises condensable hydrocarbons.

5450. (new) The method of claim 5449, wherein the part of the formation comprises a selected section.

5451. (new) The method of claim 5449, wherein the part of the formation comprises a pyrolysis zone.

5452. (new) The method of claim 5449, wherein at least one heater comprises a natural distributed combustor.

5453. (new) The method of claim 5449, wherein at least one heater is disposed in an open wellbore.

5454. (new) The method of claim 5449, wherein the condensable hydrocarbons have an API gravity of at least about 25°.

5455. (new) The method of claim 5449, further comprising controlling a pressure and a temperature within at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5456. (new) The method of claim 5449, wherein providing heat from the heaters to the portion of the formation comprises:

heating a selected volume (V) of the formation from one or more of the heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

Response To Office Action Mailed October 8, 2002

A. Pending Claims

Claims 1058-1096, 5397, and 5440-5456 are pending in the case. Claims 5398-5439 have been canceled. Claims 1058-1063, 1067, 1069, 1094-1096, and 5397 have been amended. Claims 5440-5456 are new.

B. Interview With The Examiner

On December 17, 2002 Applicant's representative Neal E. Persky (P-53,452) contacted the Examiner by phone. Applicant sincerely appreciates the Examiner taking the time to discuss the case. In the interview Applicant requested a new copy of the Office Action due to the fact that several pages of the Office Action sent to Applicant were missing. Applicant received a facsimile of the Office Action.

C. Information Disclosure Statements

Applicant has not received signed PTO 1449 forms for references A283-A337 (pages 2-3 of 4). The Information Disclosure Statement including the above-mentioned references was submitted on December 6, 2001. The return receipt postcard from the Patent and Trademark Office has a date stamp of December 18, 2001.

Applicant has not received signed PTO 1449 forms for references A233-A256 and B1 (page 9 of 9). The Information Disclosure Statement including the above-mentioned references was submitted on December 7, 2001. The return receipt postcard from the Patent and Trademark Office has a date stamp of December 17, 2001.

Applicant has not received signed PTO 1449 forms for references C90-C105 and D1-D8 (page 4 of 5). The Information Disclosure Statement including the above-mentioned references was submitted on April 16, 2002. The return receipt postcard from the Patent and Trademark Office has a date stamp of April 19, 2002.

Applicant has not received signed PTO 1449 forms for references E1-E15 (page 1 of 1). The Information Disclosure Statement including the above-mentioned references was submitted on May 29, 2002. The return receipt postcard from the Patent and Trademark Office has a date stamp of June 3, 2002. Applicant has received a signed PTO 1449 for an Information Disclosure Statement submitted subsequent to May 29, 2002.

Applicant has not received signed PTO 1449 forms for references G1-G4 (page 1 of 1). The Information Disclosure Statement including the above-mentioned references was submitted on July 1, 2002. The return receipt postcard from the Patent and Trademark Office has a date stamp of July 8, 2002. Applicant has received a signed PTO 1449 for an Information Disclosure Statement submitted subsequent to July 1, 2002.

Applicant requests signed PTO 1449 forms for the above noted Information Disclosure Statements.

D. Submission of Corrected Formal Drawings

In the Office Action mailed October 8, 2002, the Examiner indicated approval of the proposed drawing corrections. Applicant submits the corrected formal drawings approved by the Examiner (nine sheets, including FIGS. 23a, 23b, 32, 56, 57, 67, 68, 72, 73, 76, 81a, and 97).

E. Provisional Double Patenting Rejection

In item 6-8 of the Office Action, the Examiner noted the possibility of conflicting claims between the following related U.S. Patent applications filed by the Applicant:

09/840,936; 09/840,937, 09/841,000; 09/841,060; 09/841,061; 09/841,127;
09/841,128; 09/841,129; 09/841,130; 09/841,131; 09/841,170; 09/841,193;
09/841,194; 09/841,195; 09/841,238; 09/841,239; 09/841,240; 09/841,283;
09/841,284; 09/841,285; 09/841,286; 09/841,287; 09/841,288; 09/841,289;
09/841,290; 09/841,291; 09/841,292; 09/841,293; 09/841,294; 09/841,295;
09/841,296; 09/841,297; 09/841,298; 09/841,299; 09/841,300; 09/841,301;
09/841,302; 09/841,303; 09/841,304; 09/841,305; 09/841,306; 09/841,307;
09/841,308; 09/841,309; 09/841,310; 09/841,311; 09/841,312; 09/841,429;
09/841,430; 09/841,431; 09/841,432; 09/841,433; 09/841,434; 09/841,435;
09/841,436; 09/841,437; 09/841,438; 09/841,439; 09/841,440; 09/841,441;
09/841,442; 09/841,443; 09/841,444; 09/841,445; 09/841,446; 09/841,447;
09/841,448; 09/841,449; 09/841,488; 09/841,489; 09/841,491; 09/841,492;
09/841,493; 09/841,494; 09/841,495; 09/841,496; 09/841,497; 09/841,498;
09/841,499; 09/841,500; 09/841,501; 09/841,502; 09/841,632; 09/841,633;
09/841,634; 09/841,635; 09/841,636; 09/841,637; 09/841,638; and 09/841,639.

Applicant respectfully traverses the provisional double patenting rejection. Applicant respectfully submits that the omnibus nature of this rejection does not provide Applicant with sufficient detail in which to address such rejection. Applicant also respectfully submits that the rejection is also inconsistent with certain restrictions issued in the above-referenced cases. Applicant respectfully requests reconsideration.

Pursuant to the discussion in an Examiner interview on August 19, 2002, for the convenience of the Examiner, Applicant will forward copies of allowed claims for the above-referenced cases to the Examiner. Applicant understands that the Examiner will review the allowed claims for the above-referenced cases and then reconsider the double patenting rejection in view of such allowed claims.

F. The Claims Are Not Indefinite Pursuant To 35 U.S.C. § 112, Second Paragraph

Claims 1058, 1059, 1063-1096, and 5397 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states "Claim 1058 recites the limitation 'a pyrolysis zone' in line 3. There is insufficient antecedent basis for this limitation in the claim. In this regard, the claim must positively recite a step of establishing such a 'pyrolysis zone'." Applicant respectfully disagrees that the claims are indefinite.

Applicant's claims, interpreted in light of the disclosure, must reasonably apprise a person of ordinary skill in the art of the invention. However, the applicant need not explicitly recite in the claims every feature of the invention. For example, if an applicant indicates that the invention is a particular computer, the claims do not have to recite every element or feature of the computer. In fact, it is preferable for claims to be drafted in a form that emphasizes what the applicant has invented (i.e., what is new rather than old). *In re Dossel*, 115 F.3d 942, 946, 42 USPQ2d 1881, 1884 (Fed. Cir. 1997). Applicant requests removal of the rejections of claims 1058; 1059, 1063-1096, and 5397.

G. The Claims Are Not Anticipated By, Or Obvious Over Camacho and Hobson Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 1058, 1065, 1070-1084, 1095, 1096, 1091, and 1092 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 4,067,390 to Camacho et al. ("Camacho") and the reference to MODERN PETROLEUM TECHNOLOGY by Hobson. Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); In re Donahue, 766 F.2d 531,226 U.S.P.Q. 619,621 (Fed. Cir. 1985). To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

The Examiner states:

> Camacho et al (col. 6, line 20 – col. 11, line 21) discloses a process for heating a coal or hydrocarbon formation wherein the heat imparted causes devolatilization and gasification of the coal. Camacho et al further calls for monitoring the composition of the product gases and controlling such product composition by one or more steps such as controlling the operating pressure within the coal formation. Insofar as a hydrocarbon having a carbon number greater than 25 normally possesses a constituency of a wax, as noted by Hobson in Table I on page 787, it is deemed that the volatiles and product gas comprising the production effluent in the coal treating process of Camacho et al will necessarily or obviously not include any such hydrocarbons having a carbon number greater than 25 since, as noted by Hobson, such hydrocarbon(s) would not comprise a "volatile", per se (note, e.g., the high melting points listed).

Amended claim 1058 describes a combination of features including: "allowing the heat to transfer from the one or more heaters to a pyrolysis zone of the formation; controlling a pressure within the formation to inhibit production of hydrocarbons from the formation having

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carbon numbers greater than 25; and producing a mixture from the formation." Applicant submits that support for the amendment can be found at least in the specification on page 40, lines 1-7. At least the quoted features of claim 1058, in combination with the other features of the claim, do not appear to be taught or suggested by the cited art.

Camacho discloses:

> According to the embodiment described in FIG. 10, it is a primary object to decrease the viscosity of the entrapped oil in a tar sand deposit 60 so that it will flow downwardly to the bottom of the well shaft and be pumped to the surface for collection. As the deposit is heated, the water in the deposit will begin to boil off at approximately 100°C and escape through the well as steam. Mixed with the steam there may be a volume of useful hydrocarbon containing gases which are produced by the pyrolysis of the tar sands in high temperature zones near the torch. It is necessary to heat the entrapped oil to approximately 200°C to decrease its viscosity to a point that it will flow to a collection reservoir. The boiling off of the steam and the heating of the entrapped oil serve to increase the porosity of the sand in an outward direction from the well. Thus, the flow of oil from the deposit will always be directed inwardly toward the well. The increased prosoity also allows good heat transfer outwardly into the deposit.
>
> In the case of oil shale the process is similar, with only minor variations. Oil shale is a solid that contains kerogen, a solid hydrocarbon. Kerogen, when raised to temperatures of approximately 400°C decomposes to form liquid shale oil, similar to crude oil. A solid carbonaceous coke residue, about 25% of the kerogen by weight and similar in composition to the fixed carbon in the devolatilized zone described previously for coal pyrolysis, remains underground. This decomposition of the oil shale rock serves to increase the porosity of the formation in an outward direction from the shaft. Thus, the flow of oil from the deposit will be directed inward toward the well and down into a collection reservoir. The addition of steam to the process, as described previously for coal pyrolysis, may be added to gasify the fixed carbon residue and produce additional gaseous fuel products where economically justified. (Camacho, column 11, line 43 through column 12, line 10)

Camacho appears to teach or suggest heating tar sands formations and oil shale deposits to at least 200°C and 400°C, respectively, to decrease the viscosity and/or form liquid shale oil that will flow to a collection reservoir. Hobson reports a melting point of 53.5°C for hydrocarbons with a carbon number of 25 in TABLE I on page 787. Camacho does not appear to teach or suggest any specific means for inhibiting production of hydrocarbons with a carbon number greater than 25.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), MPEP § 2143.

Applicant submits that treatment of a formation, or a portion of a formation, may be controlled (e.g., controlling the pressure) to obtain selected results. In addition, providing a selected amount of heating energy/day to a volume of a formation may be used to obtain selected results.

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Applicant submits that many of the claims dependent on claim 1097 are separately patentable.

Claim 1065 describes a combination of feature including: "wherein controlling the temperature comprises maintaining a temperature within the pyrolysis zone within a pyrolysis temperature range." At least the quoted feature of claim 1065, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner stated: "Regarding claims 1070-1084, it is deemed that the myriad hydrocarbon product mixtures recited in these claims would necessarily or obviously occur in carrying out the heating process of Camacho et al, i.e., the precise composition of the product fluids is seen as dictated by the type of coal naturally occurring in the particular formation actually encountered in the field." Applicant submits that the product mixtures recited in claims 1070-1084 would not be producible by carrying out the heating process of Camacho. The process conditions dictated in Camacho would not appear to teach or suggest the ability to produce product mixtures as claimed in claims 1070-1084. The Examiner appears to be unjustifiably extending the teaching of Camacho. Applicant requests the removal of the rejections of claims 1070-1084.

The Examiner states:

> Such permeability increase is deemed to necessarily or inherently encompass an increase to "greater than about 100 millidarcy", as called for in claim 1091; alternatively, to increase the permeability to greater than 100 millidarcy would have been an obvious matter of choice in order to ensure adequate fluid flow through the formation.

Claim 1091 describes a combination of features including: "wherein allowing the heat to transfer comprises increasing a permeability of a majority of the pyrolysis zone to greater than about 100 millidarcy." At least the quoted feature of claim 1091, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

The Examiner states:

> Camacho et al further effects "cracking or fracturing" of the coal, e.g., as illustrated by zone (40,40') of Figures 4 and 5. Such heating effect on the coal formation is deemed to necessarily or obviously increase the permeability, as called for in claims 1091, 1092. It is further deemed that such permeability increase will inherently or obviously be substantially uniform, as called for in claim 1092 as illustrated in Figures 4 and 5.

Amended claim 1092 describes a combination of features including: "wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the pyrolysis zone." Camacho discloses: "The heat from torch 25 first causes the volatiles to be stripped from the surrounding coal. This devolatilization results in a cracking or fracturing of the coal, thereby increasing its porosity. The devolatilization and fracturing expands radially outwardly as a heat front advances from shaft 20." (Camacho, column 7, lines 59-64). Camacho further discloses: "The diameter of the spherical voids 20'' remaining after gasification will vary with the composition of the coal and with the amount of heat supplied; the distance maintained between adjacent shafts during drilling should be determined accordingly to provide sufficient support." (Camacho, column 9, lines 31-36). At least the quoted features of claim 1092, in combination with the other features of the claim, do not appear to be taught or suggested by the cited art.

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H. The Claims Are Not Obvious Over Camacho And Hobson Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 1066-1069, 1085-1087, and 1093-1096 under 35 U.S.C. 103(a) as obvious over Camacho and Hobson. Applicant respectfully disagrees with these rejections.

In the Office Action, the Examiner states: "The precise heating rate and thermal conductivity recited in claims 1066 and 1067 are deemed obvious matters of choice or design based on, e.g., the quality and amount of the in place hydrocarbon present in the particular hydrocarbon formation encountered in the field, consistent with objective of Camacho to provide a low rate of heating (col. 10, lines 34-40)." Applicant respectfully disagrees.

Claim 1066 describes a combination of features including: "controlling a heating rate such that an average heating rate of the pyrolysis zone is less than about 1 °C per day during pyrolysis." Claim 1067 describes a combination of features including: "wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day." The quoted features of claims 1066 and 1067, in combination with the other features of the claims, do not appear to be taught or suggested by Camacho.

Treatment of a formation, or a portion of a formation, may be controlled (e.g., controlling the heating rate) to obtain selected results. In addition, providing a selected amount of heating energy/day to a volume of a formation may be used to obtain selected results.

Camacho does not appear to teach or suggest controlling heating of the formation to obtain selected results or providing a selected amount of heating energy/day to a volume of a formation to obtain selected results.

Camacho appears to teach heating the formation at a relatively high heating rate. As

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stated above, Camacho appears to teach using a heat output of about 219,800 watts per meter to about 1,099,015 watts per meter. Heat outputs in this range would heat a formation at a relatively rapid rate. Applicant submits that the process of Camacho could not be used to heat a formation at the heating rates suggested in claim 1066 and/or claim 1067. The "low" heating rate of Camacho is low enough to inhibit glazing of the formation. The heating rate is not a low heating rate as claimed in the present application.

Claim 1068 describes a combination of feature including: "wherein allowing the heat to transfer comprises transferring heat substantially by conduction." At least the quoted feature of claim 1068, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner states: "The thermal conductivity recited in claim 1069 is deemed an obvious matter of choice or design based on, e.g., the quality and amount of the in place hydrocarbon present and/or the matrix of characteristics of the particular hydrocarbon formation encountered in the field." Applicant respectfully disagrees.

Claim 1069 describes a combination of features including: "wherein providing heat from the one or more heaters comprises heating the selected formation such that a thermal conductivity of at least a portion of the pyrolysis zone is greater than about 0.5 W/(m °C)." Applicant submits that the quoted features of claim 1069, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Applicant submits that providing heat from one or more heaters such that a thermal conductivity of a portion of a formation is greater than about 0.5 W/(m °C) is unexpected based on literature in the art. For example, Applicant's specification states:

> Certain embodiments described herein will in many instances be able to economically treat formations that were previously believed to be uneconomical. Such treatment will be possible because of the surprising increases in thermal conductivity and thermal diffusivity that can be achieved with such embodiments. These surprising results are illustrated by the fact that prior literature indicated that certain hydrocarbon containing formations, such as coal, exhibited relatively low values for thermal conductivity and thermal diffusivity when heated. For

example, in government report No. 8364 by J. M. Singer and R. P. Tye entitled "Thermal, Mechanical, and Physical Properties of Selected Bituminous Coals and Cokes," U.S. Department of the Interior, Bureau of Mines (1979), the authors report the thermal conductivity and thermal diffusivity for four bituminous coals. This government report includes graphs of thermal conductivity and diffusivity that show relatively low values up to about 400 °C (e.g., thermal conductivity is about 0.2 W/(m °C) or below, and thermal diffusivity is below about 1.7 x 10^{-3} cm^2/s). This government report states that "coals and cokes are excellent thermal insulators."

In contrast, in certain embodiments described herein hydrocarbon containing resources (e.g., coal) may be treated such that the thermal conductivity and thermal diffusivity are significantly higher (e.g., thermal conductivity at or above about 0.5 W/(m °C) and thermal diffusivity at or above 4.1 x 10^{-3} cm^2/s) than would be expected based on previous literature such as government report No. 8364. If treated as described in certain embodiments herein, coal does not act as "an excellent thermal insulator." Instead, heat can and does transfer and/or diffuse into the formation at significantly higher (and better) rates than would be expected according to the literature, thereby significantly enhancing economic viability of treating the formation.
(Specification, page 150, line 18 to page 151, line 10).

Applicant respectfully submits that the Examiner's rejection of the features of claim 1069, in combination with the other features of the claim, as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by references brought to the Applicant's attention. Otherwise, Applicants request this rejection be removed. *See, e.g.*, MPEP 2143.01.

In the Office Action, the Examiner states:

> The steps of 1085-1087, 1093 such as controlling the heat or pressure in the formation, are deemed obvious matters of choice or design in carrying out the process of Camacho et al. In this regard, Camacho et al teaches that steam injection temperature, pressure and/or volume may be controlled in response to monitoring of the fluid products. In addition, overall operating conditions within the hydrocarbon formation may be altered (noted col. 5, lines 20-27) to vary the product fluid composition(s).

Applicant respectfully disagrees that the steps are obvious matters of choice or design.

Applicant submits that controlling and/or altering the pressure or heat as recited in claims 1085-1087, 1093 provides unexpected and/or improved results based on the prior art. For example, Applicant's specification states:

> In an embodiment, a pressure within a heated portion of the formation may surprisingly increase the quality of relatively high quality pyrolyzation fluids, the quantity of relatively high quality pyrolyzation fluids, and/or vapor phase transport of the pyrolyzation fluids within the formation. Increasing the pressure often permits production of lower molecular weight hydrocarbons since such lower molecular weight hydrocarbons will more readily transport in the vapor phase in the formation. Generation of lower molecular weight hydrocarbons (and corresponding increased vapor phase transport) is believed to be due, in part, to autogenous generation and reaction of hydrogen within a portion of the hydrocarbon containing formation. For example, maintaining an increased pressure may force hydrogen generated in the heated portion into a liquid phase (e.g. by dissolving). In addition, heating the portion to a temperature within a pyrolysis temperature range may pyrolyze at least some of the hydrocarbons within the formation to generate pyrolyzation fluids in the liquid phase. The generated components may include a double bond and/or a radical. H_2 in the liquid phase may reduce the double bond of the generated pyrolyzation fluids, thereby reducing a potential for polymerization of the generated pyrolyzation fluids. In addition, hydrogen may also neutralize radicals in the generated pyrolyzation fluids. Therefore, H_2 in the liquid phase may substantially inhibit the generated pyrolyzation fluids from reacting with each other and/or with other compounds in the formation. In this manner, shorter chain hydrocarbons may enter the vapor phase and may be produced from the formation.
>
> Increasing the formation pressure to increase the amount of pyrolyzation fluids in the vapor phase may significantly reduce the potential for coking within the selected section of the formation. A coking reaction may occur in the liquid phase. Since many of the generated components may be transformed into short chain hydrocarbons and may enter the vapor phase, coking within the selected section may decrease.
>
> Increasing the formation pressure to increase the amount of pyrolyzation fluids in the vapor phase is also beneficial because doing so permits increased recovery of lighter (and relatively high quality) pyrolyzation fluids. In general, pyrolyzation fluids are more quickly produced, with less residuals, when such fluids are in the vapor phase rather than in the liquid phase. Undesirable polymerization reactions also tend to occur more frequently when the pyrolyzation fluids are in the liquid phase instead of the vapor phase. In addition, when pyrolyzation fluids are produced in the vapor phase, fewer production wells/area are needed, thereby reducing project costs. (Specification, page 130, line 16 to page 131, line 18)

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The features of claims 1085-1087, 1093 do not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner states:

> Regarding claims 1094-1096, Camacho et al in the embodiment of Figure 10 discloses that myriad heating wells (65) surround a production well or shaft (74). The precise number of such heating wells provided, as called for in these claims, is deemed an obvious matter of choice or design in carrying out the process of Camacho et al based on, e.g., the overall areal extent of the hydrocarbon formation(s) encountered in exploiting an actual reservoir encountered in the field.

Applicant respectfully disagrees that the number of heating wells provided, as called for in claims 1094-1096, is an obvious matter of choice or design.

The number of heaters provided for a production well may be selected based on various factors including, but not limited to, producing selected products and/or compositions from a formation. For example, Applicant's specification states:

A ratio of heaters to production wells may vary, however, depending on, for example, the desired heating rate of the hydrocarbon containing formation, the heating rate of the heaters, the type of heater, the type of hydrocarbon containing formation, the composition of hydrocarbon containing formation, the desired composition of the produced fluid, and/or the desired production rate. Providing more heaters wells per unit area will allow faster heating of the selected portion and thus hastening the onset of production, however more heaters will generally cost more money to install. An appropriate ratio of heaters to production wells may also include ratios greater than about 5:1, and ratios greater than about 7:1. In some embodiments an appropriate ratio of heaters to production wells may be about 10:1, 20:1, 50:1 or greater. If larger ratios are used, then project costs tend to decrease since less wells and equipment are needed. (Specification, page 72, lines 19-30)

Applicant submits that the selection of the number of heater wells provided for a production well is not an obvious matter of choice or design but, rather, may be based upon non-obvious choices such as desired product composition, desired production rates, desired heating

rates, etc.

I. The Claims Are Not Anticipated By, Or Obvious Over Schlinger And Slater Pursuant To 35 U.S.C. § 102(b) or 103(a) Respectively

The Examiner rejected claims 1058, 1059, 1063, 1065-1086, 1088, 1089, and 1091-1093 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,617,471 to Schlinger et al. ("Schlinger") and U.S. Patent No. 3,084,919 to Slater ("Slater"). Applicant respectfully disagrees with these rejections.

The Examiner states:

> Schlinger et al discloses a process for pyrolysis and hydroretorting a subterranean oil shale deposit or formation, which may be initially heated or exploited by the process of Slater (as referred to in col. 2, lines 62-67 of Schlinger).

Claim 1058 describes a combination of features including: "providing heat from one or more heaters to at least a portion of the formation; allowing the heat to transfer from the one or more heaters to a pyrolysis zone of the formation." Applicant submits that at least the quoted features of claim 1058, in combination with the other features of the claim, do not appear to be taught or suggested by the cited art.

Schlinger discloses:

> Injecting water into the oil shale reaction zone was found to have several new, and unobvious results. It was unexpectedly found that when water is added to the oil shale reaction zone, the endothermic decomposition of inorganic carbonates in the shale and the production of CO_2 is repressed. This saves hydrogen, as CO_2 would ordinarily react with H_2 to form H_2O and CO. Thus by water injection, there is a savings of energy in the form of heat ordinarily consumed by the decomposition of inorganic carbonates; and further, there is considerable reduction of hydrogen consumption in the reaction zone. Further, the mass velocity through the oil shale reaction zone, and the heat transfer coefficient of the mixture in the reaction zone are all increased by the addition of H_2O. Thus, rapid heat transfer is effected which allows conversion of the kerogen to crude shale oil in the oil shale reaction zone at a residence time in the range of

about one-fourth minute to 2 hours. (Schlinger, column 2, line 68 through column 3, line 8)

Slater discloses:

> By providing a plurality of well bores, as illustrated in the figure, the gas holder requirements may be minimized or eliminated. With a multiplicity of wells, some wells may be in the preheat stage while others are in the pressuring, processing, or depressuring stages. Leakage or migration of oil and gas from one well to another is not detrimental and is generally beneficial. When such leakage progresses to the point where flow of gas is established from one well to the next, oil may be produced through the tubing string of one well at the same time as hydrogen is introduced to the other. Also, when this condition exists, the formation may be heated during the heating period by in sit combustion within the formation with either concurrent or countercurrent movement of the flame front and the combustion air through the formation between communicating well bores. In situ combustion techniques are well known in the art. (Slater, column 3, lines 13-29)

Schlinger appears to teach or suggest a preferred embodiment of heating the formation using super-heated steam to permeate the formation. Slater appears to teach or suggest heating oil shale deposits via combustion and fire fronts as a preferred embodiment. Neither Schlinger nor Slater appears to teach or suggest providing heat from heaters and allowing the heat to transfer from the heaters to a pyrolysis zone.

Applicant respectfully disagrees that the claims rejected by the Examiner are anticipated or obvious in light of Schlinger or Slater. Applicant submits that many of the dependent claims rejected by the Examiner are independently patentable.

For example, claim 1059 describes a combination of features including: "wherein the one or more heaters comprise at least two heaters, and wherein superposition of heat from at least the two heaters pyrolyzes at least some hydrocarbons within the pyrolysis zone of the formation." Applicant submits that the quoted features of claim 1059, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

Claim 1063 describes a combination of features including: "wherein at least one of the

heaters comprises a natural distributed combustor." Applicant submits that the quoted feature of claim 1063, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 1065 describes a combination of features including: "wherein controlling the temperature comprises maintaining a temperature within the pyrolysis zone within a pyrolysis temperature range." Applicant submits that the quoted feature of claim 1065, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

The Examiner states:

> It is deemed that the precise heating rates set forth in claims 1066 and 1067, as well as the thermal conductivity recited in claims 1069, will inherently or obviously occur during the process of Schlinger et al, as applied to the oil shale formation completed by Slater, based on or dictated by, e.g., the characteristics and properties of the oil shale formation actually encountered in the field.

Applicant respectfully disagrees that the heating rates in claims 1066 and 1067 will inherently or obviously occur during the process of Schlinger et al. as applied to the oil shale formation completed by Slater.

Applicant submits that treatment of a formation, or a portion of a formation, may be controlled (e.g., controlling the heating rate) to obtain selected results. In addition, providing a selected amount of heating energy/day to a volume of a formation may be used to obtain selected results as described in Section H. Applicant submits that providing heat from one or more heaters such that a thermal conductivity of a portion of a formation is greater than about 0.5 W/(m °C) is unexpected based on literature in the art, as described in Section H. Therefore, providing heat from one or more heaters heating a selected section at a specific heating rate and/or such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C) is not an obvious matter of choice or design.

Claim 1068 describes a combination of features including: "wherein allowing the heat to transfer comprises transferring heat substantially by conduction." Applicant submits that the

quoted feature of claim 1068, in combination with the other features of the claim, does not appear to be taught or suggested by the cited art.

In the Office Action, the Examiner stated: "Regarding claims 1070-1084, it is deemed that the myriad hydrocarbon product mixtures recited in these claims would necessarily or obviously occur in carrying out the heating process of Schlinger et al, i.e., the precise composition of the product fluids is seen as dictated by the type of coal naturally occurring in the particular formation actually encountered in the field." Applicant submits that the product mixtures recited in claims 1070-1084 would not be producible by carrying out the heating process of Schlinger et al. The process conditions dictated in Schlinger et al. do not appear to teach or suggest the ability to produce product mixtures as claimed in claims 1070-1084. The Examiner appears to be unjustifiably extending the teaching of Schlinger et al. Applicant requests the removal of the rejections of claims 1070-1084.

Claim 1085 describes a combination of features including: "controlling the pressure within at least a majority of the pyrolysis zone of the formation, wherein the controlled pressure is at least about 2.0 bar absolute." Applicant submits that the quoted features of claim 1085, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

The Examiner states:

> As per claim 1086, Schlinger et al (col. 4, line 49-col. 5, line 6) discloses that hydrogen is also produced with the production effluent; the exemplary range of hydrogen of 45-85% of a non-condensable gas effluent of the production mixture would inherently or obviously represent a partial pressure of hydrogen > .5 bar.

Claim 1086 describes a combination of features including: "controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar." Applicant submits that the quoted features of claim 1086, n combination with other features of the claim, do not appear to be taught or suggested by the cited art.

Claim 1088 describes a combination of features including: "wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation." Applicant submits that the quoted feature of claim 1088, in combination with other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 1089 describes a combination of features including: "providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and heating a portion of the section with heat from hydrogenation." Applicant submits that the quoted features of claim 1089, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

The Examiner states:

> As per claims 1091 and 1092, Schlinger et al (col. 5, lines 7-16) further indicates that a fractured and resulting "porous structure of the shale" will occur during their heating process. It is further deemed that such permeability increase will inherently or obviously be substantially uniform, as called for in claim 1092. Such permeability increase is deemed to necessarily or inherently encompass an increase to "greater than about 100 millidarcy", as called for in claim 1091; alternatively, to increase the permeability to greater than 100 millidarcy would have been an obvious matter of choice in order to ensure adequate fluid flow through the formation.

Applicant respectfully disagrees with these rejections.

Claim 1091 describes a combination of features including: "wherein allowing the heat to transfer comprises increasing a permeability of a majority of the pyrolysis zone to greater than about 100 millidarcy." Applicant submits that the quoted features of claim 1091, in combination with other features of the claim, do not appear to be taught or suggested by the cited art.

Claim 1092 describes a combination of features including: "wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the pyrolysis zone." Applicant submits that the quoted feature of claim 1092, in combination with

other features of the claim, does not appear to be taught or suggested by the cited art.

Claim 1093 describes a combination of features including: "controlling a heating rate to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay." Applicant submits that the quoted feature of claim 1093, in combination with other features of the claim, does not appear to be taught or suggested by the cited art.

J. The New Claims Are Not Anticipated or Obvious in view of the Cited Art

Applicant believes that new claim 5442 and the claims dependent thereon do not read on the cited prior art. For example, Camacho does not teach or suggest at least the feature of providing heat from one or more heaters to at least a portion of the formation, wherein one or more heaters provides a heat output of less than about 1650 watts per meter, in combination with the other features of the claims. Applicant believes that new claim 5449 and the claims dependent thereon do not read on the cited prior art. For example, Camacho does not teach or suggest at least the feature of producing a mixture from the formation, wherein the mixture comprises condensable hydrocarbons, in combination with the other features of the claims. Other cited references do not appear to teach or suggest at least the feature of the use of heaters, in combination with the other features of the claims.

K. Conclusion

Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

It is believed that no fees are due in association with the filing of this and accompanying documents. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are required, please appropriately charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C.. Deposit Account Number 50-1505/5659-01100/EBM.

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Respectfully submitted,

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